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ABSTRACT

Growth in the number of graduate students enrolled in science programs appears to have halted in fall 1977; estimates indicate a possible one percent downturn. The slowdown in both full- and part-time enrollment at the graduate level may be attributed in part to a steady increase in the number of job opportunities available to graduates below the doctorate level; other influences include continuing decreases in direct federal support to graduate students, rising tuition costs and living expenses, and expiration of veterans' benefits. Full-time enrollment of women in graduate science programs has increased steadily between 1972 and 1976; women accounted for a 27 percent share of the full-time total in 1976, compared to an 18 percent share in 1972. Recent emphasis on affirmative action and equal employment opportunity has been influential. (MSE)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

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Graduate Science Enrollment Stabilized in 1977

This report presents information from the fourth annual NSF Quick Response Survey (QRS) of fall 1977 graduate science and engineering (S/E) enrollment coupled with the final results of the fall 1976 Survey of Graduate Science Student Support and Postdoctorals (GSSSP). The QRS results represent national enrollment estimates based on returns from a sample of 1,578 graduate departments in 326 master's- and 361 doctorate-granting institutions (including 105 medical schools). Institutions were asked to provide estimates early in the academic year 1977-78 of total full- and part-time enrollment and the number of full-time students enrolled in their first year of study. The 1976 GSSSP findings are the result of a full-scale survey of all institutions granting a graduate science degree. The term "science" as used here is understood to include engineering.

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Assessment Highlights

• Growth in the number of graduate students enrolled in science programs appears to have halted in fall 1977; estimates available from the QRS indicate a possible 1-percent downturn (table 1). The slowdown in both full- and part-time S/E enrollment at the graduate level may be attributed in part to a steady increase in the number of job opportunities available to graduates below the doctorate level. Other influences include continuing decreases in direct Federal support to graduate students, rising tuition costs and living expenses, and an expiration of G.I. Bill benefits which reduced graduate veteran enrollment by 35 percent in 1976.

• The enrollment of women on a full-time basis in graduate science programs has increased steadily between 1972 and 1976; women accounted for a 27-percent share of the full-time total in 1976 compared to an 18-percent share in 1972. Recent emphasis on affirmative action and equal employment opportunity has increased the demand for women in S/E fields. The increase in the number of women enrolling in graduate S/E programs is seen as a response to growing job opportunities and rising salary levels.

Data Highlights

• The 228,600 S/E students estimated as enrolled on a full-time schedule represented an estimated decline of 2 percent between 1976 and 1977. Part-timers continued to rise at a 2-percent rate, which is, however, slower than in previous years, reaching 113,700.

• Graduate-S/E enrollment in doctorate institutions has shown an overall growth of 12 percent thus far in the seventies, but this period was subject to many crosscurrents. An enrollment low point was reached in 1973, followed by growth in each of the next three years. A 2-percent drop is estimated for 1977, offsetting the previous year's rise, and placing doctorate institutions in a "no growth" state (chart 1).

• The number of students receiving Federal support remained fairly steady between 1975 and 1976; however, the mechanisms through which this support was directed varied significantly. Federal obligations for fellowships, traineeships, and training grants fell 10 percent between fiscal years 1975 and 1976, while federally supported fellows/trainees declined 7 percent. On the other hand, the number of federally supported research assistants

Table 1. Graduate science enrollment by area: 1976 and 1977[1]

Area of science	1976[2]	1977 (est.)[3]	Percent change	Range of percent change at 90-percent confidence level
Total, all areas	345,700	342,300	-1.0	-2.2 to 0.2
Engineering	67,100	66,000	-1.6	-4.0 to .8
Physical sciences	26,800	26,500	-1.0	-3.5 to 1.4
Environmental sciences	11,900	12,000	.2	-4.9 to 5.4
Mathematical sciences	24,600	22,900	-6.8	-11.2 to -2.4
Life sciences	82,400	83,200	1.0	-1.1 to 3.1
Agricultural sciences	13,200	13,000	-1.3	-6.0 to 3.4
Biological sciences	47,800	47,100	-1.6	-4.4 to 1.2
Health sciences	21,400	23,100	8.3	4.1 to 12.6
Psychology	38,500	38,400	(4)	-3.9 to 3.8
Social sciences	94,500	93,300	-1.3	-4.1 to 1.7

[1] Based on full- and part-time enrollment at both master's- and doctorate-granting institutions.

[2] From Survey of Graduate Science Student Support and Postdoctorals, Fall 1976 (GSSSP)

[3] Estimates from 1977 Quick Response Survey (QRS)

[4] Less than 0.05-percent change.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Prepared in the Division of Science Resources Studies, Universities and Nonprofit Studies Group.

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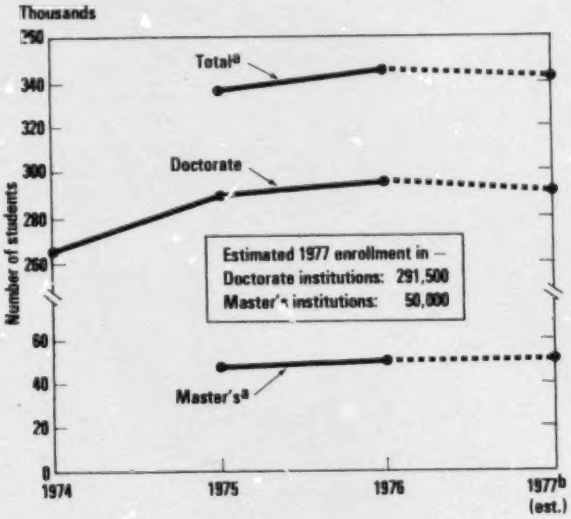
Chart 1. Graduate science enrollment by level of institution: 1974-77



[a]Data for 1974 are not available.
[b]Estimates from 1977 Quick Response Survey (QRS).
SOURCE: National Science Foundation

continued to grow—up 6 percent between 1975 and 1976—although the gain offset little more than one-half of the loss in fellows/trainees.

Enrollment and Employment Patterns

The graduate S/E enrollment estimates provided by the 1977 QRS indicate that the recent growth pattern may have flattened out. The Council of Graduate Schools surveyed its member institutions and reported a similar "no growth" period in 1976-77, up only 0.2 percent in all graduate programs.[1] Several factors may have contributed to the leveling off of enrollment in all graduate S/E programs, such as: (1) The continuing decrease in direct Federal support for graduate science students; (2) the expiration of G.I. Bill benefits which cut graduate veteran enrollment in institutions of higher education by 35 percent in fall 1976;[2] (3) the continued increase in tuition and living costs at the undergraduate level reported by the National Center for Education Statistics (NCES) which presumably extends to graduate and medical schools;[3] and (4) a more favorable job market for college graduates. According to a November 1977 survey, 183 of the Nation's largest employers planned to hire 14 percent more graduates with bachelor's degrees and 9 percent more master's graduates in 1978 than they hired in 1977, thus widening the job market to those with less than the doctorate degree.[4]

While graduate S/E enrollment began to level off, the academic employment of scientists and engineers rose at doctorate institutions by 3 percent and at master's institutions by 5 percent between January 1976 and January 1977.[5] This employment growth pattern is expected to continue for a variety of reasons that are independent of S/E enrollment patterns: (1) Increases in Federal dollars are budgeted for academic R&D support; (2) improvement in institutional control of personnel costs is occurring; (3) the rise in employment in S/E fields may be at the expense of the humanities and other non-S/E disciplines; and (4) the institutions are showing more flexibility in deferring nonpersonnel costs in periods of budgetary constraints.

Doctorate-Granting Institutions

Graduate science enrollment at doctorate-granting institutions declined an estimated 2 percent to 291,500 in fall 1977 after a 2-percent rise in 1976. Whether there is long-term significance to this reversal in growth patterns cannot be assessed at this time; it may prove to be only a temporary 1-year drop in the midst of generally increasing enrollment at all levels of higher education.

FULL-TIME ENROLLMENT

The QRS sample indicated a decline of 3 percent to an estimated 209,000 full-time graduate S/E students in fall 1977 that was spread over all major areas of science; this drop followed a 2-percent increase the previous year (chart 2). In 1976 the life sciences gained 5 percent more full-timers and showed the largest relative gain in part-time enrollment—an increase of 1,400 students, or 11 percent. The overall (full-time plus part-time) enrollment growth for 1977 may also be attributed to a reflection of the demand for graduates in the health fields, as predicted by a 1976 study of employment opportunities through 1985.[6]

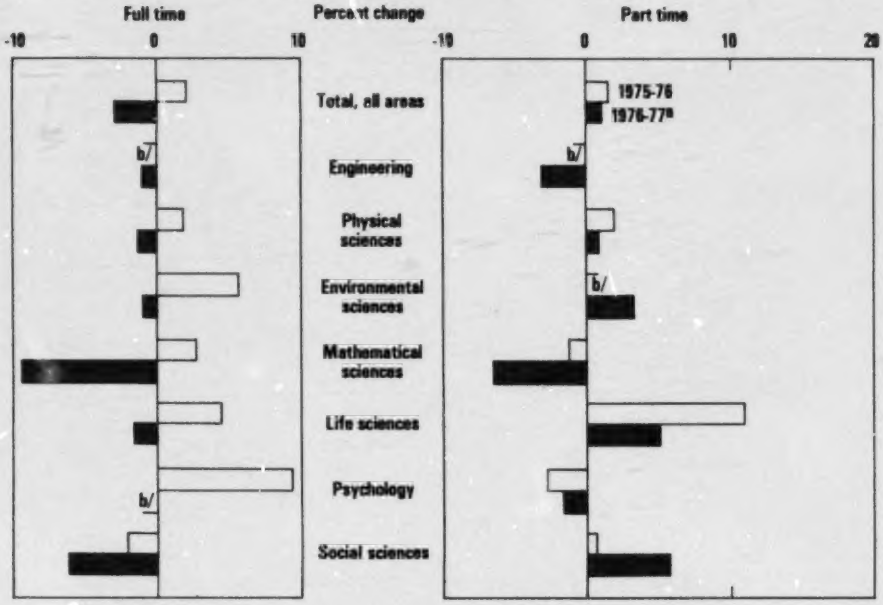
The number of full-time students in their first year of study is estimated to have dropped another 2 percent in fall 1977, following the 1-percent decrease in the 1975-76 period and the 8-percent gain the previous year.

SUPPORT PATTERNS

Although no estimates of the sources of student support were requested on the 1977 QRS form, the

[1] These results differ from those recently released by Dr. Garland G. Parker, who found that graduate enrollment increased 4 percent between 1976 and 1977. See "Slight Increase in National Collegiate Enrollments, Cincinnati Study Says," press release, University of Cincinnati, Public Information Office, February 22, 1978.
[2] See Veterans Administration, *Information Bulletin 20VB*, IB 04-77-3, appendix B, table 1 (Washington, D.C., November 1976).
[3] See Department of Health, Education, and Welfare, National Center for Education Statistics, *Projections of Education Statistics to 1985-86*, table 14 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1977).
[4] Frank S. Endicott, *The Endicott Report 1978*. (Evanston, Ill.: Northwestern University, December 1977).
[5] See National Science Foundation, *Detailed Statistical Tables, Manpower Resources for Scientific Activities at Universities and Colleges, January 1977* (NSF 77-321) (Washington, D.C. 20550, 1977).
[6] See Department of Labor, Bureau of Labor Statistics, *Occupational Projections and Training Data*, Bulletin 1918 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1976).

Chart 2. Graduate enrollment at doctorate-granting institutions by area and enrollment status: 1975-77



[a]Estimates from 1977 Quick Response Survey (QRS). [b]Less than 0.5 percent change. SOURCE: National Science Foundation

pattern of diminishing Federal support and a concurrent shift to institutional and self-support is expected to continue. In 1976 the Survey of Graduate Science Student Support and Postdoctorals (GSSSP) showed that the largest percentage of full-time students relied on institutional and State and local government support as their principal source of funding (37 percent), followed by another 32 percent dependent on self-support, including loans. Federal funds were the primary source of support for only 23 percent, while the remaining 8 percent received support from other outside sources, such as industry, foreign governments, and private foundations. These proportions were virtually the same in 1975 and are expected to remain so through 1977. But in 1971, when the Federal and institutional roles were more predominant, only 22 percent of the students relied on self-support (chart 3).

Federal agencies no longer support the majority of fellowships and traineeships as they did in the late sixties and early seventies. By 1976 only 50 percent of these mechanisms of support came from Federal sources—down from 64 percent in 1971, with no offsetting increase in nonfederally supported fellows/trainees. Since Federal obligations allocated directly through fellowships, traineeships, and training grants decreased by 10 percent in current dollars between fiscal years 1975 and 1976,[7] the number of full-time students dependent on this form of support declined by 7 percent during the same period. As no new programs of student aid in this form have been proposed in fiscal years 1977 or 1978, the number of students receiving such aid will continue to decline in 1977. Overall, the number of students receiving fellowships and traineeships from all sources decreased by 3 percent between 1975 and 1976 to 37,700.

The 42,800 students receiving their major support through research assistantships from all sources in 1976 represented a gain of 6 percent over the 1975 level, complementing the more than 2-percent rise (in 1972 constant dollars)[8] in total R&D spending by doctorate-granting institutions in fiscal year 1976.[9] Since Federal R&D obligations to universities and colleges will continue to rise in fiscal years 1978 and 1979,[10] concurrent increases are likely to occur in the number of federally supported research assistants in graduate science programs in fall 1977 and 1978.

The number of students holding teaching assistantships increased 2 percent in 1976, primarily through support from institutions and State and local governments. Students receiving "other" types of support, mainly those who were self-supporting, increased only 2 percent after an 18-percent rise in 1975.

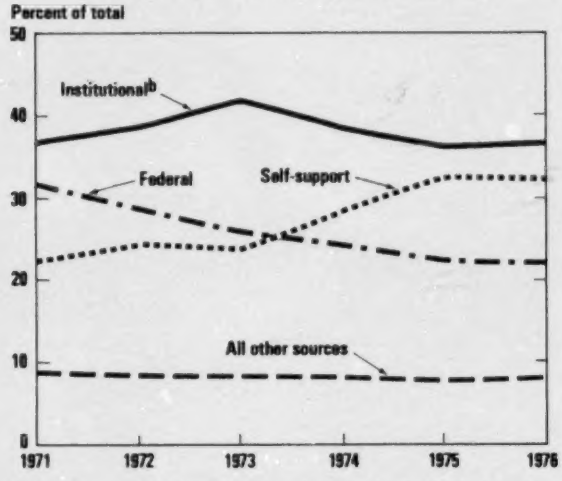
[7] See National Science Foundation, *Detailed Statistical Tables. Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1976 and Transition Quarter* (NSF 77-325) (Washington, D.C. 20550).

[8] In the absence of a reliable R&D cost index, the gross national product (GNP) implicit price deflator was used to convert R&D expenditures to constant dollars.

[9] See National Science Foundation, *Detailed Statistical Tables. Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1976* (NSF 77-316), table B-6 (Washington, D.C. 20550, 1977).

[10] See Office of Management and Budget, "Special Analysis P," *Special Analyses: Budget of the United States Government, Fiscal Year 1979*, table P-6 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, January 1978.)

Chart 3. Sources of major support of full-time graduate science students at doctorate-granting institutions: 1971-76[a]



[a]From the Survey of Graduate Science Student Support and Postdoctorals (GSSSP).
[b]Includes support from State and local governments.
SOURCE: National Science Foundation.

WOMEN IN SCIENCE PROGRAMS

Preliminary estimates by NCES of opening fall enrollment in 1977 indicate that the number of women enrolled full time at all levels of higher education and in all areas of study rose nearly 5 percent over 1976, while the number of men declined by 1 percent.[11] Although trends in graduate S/E enrollment do not necessarily follow the pattern of growth at all levels of higher education, the 1976 GSSSP results do indicate similar characteristics. As enrollment of men on a full-time basis in graduate science programs declined 1 percent in 1976, the number of women increased by 11 percent (table 2).

The continuing increase in the entrance of women into graduate science programs has been evident since the GSSSP survey was originated in 1972, when they accounted for an 18-percent share. By 1976 they had risen to a 27-percent share of the full-time total. The emphasis on affirmative action and equal employment opportunity has recently opened fields to women which in the past have been primarily male-dominated. According to a 1976 College Placement Council survey, "employers repeatedly complained of the shortage of women . . . graduates in the technical fields."[12]

CITIZENSHIP

Institutions responding to the 1976 census of foreign student enrollment conducted by the Institute of International Education reported a 13-percent increase among nonimmigrant students at all levels of higher education in the United States.[13] The influx of foreign students was also strongly evident in graduate science programs, where the number enrolled full time at doctorate-granting institutions grew 4 percent to 34,400 in 1976. This growth was at double the rate for U.S. citizens and represented the second consecutive increase in foreign enrollment after a 3-year decline. For the first time since the inception of the GSSSP survey, foreign enrollment increased at a rate higher than that of U.S. citizens; in 1976, however, foreign students accounted for only 16 percent of the total graduate S/E enrollment, down from 20 percent in 1971.

According to *Open Doors*, more foreign students were enrolled in 1976 in postsecondary levels of engineering than in any other area of study (up 17 percent since 1975), and the highest percentage increase in enrollment was in the health sciences. More students came from Iran in 1975 and 1976 than from any other country in the world, and significant enrollment growth among other members of the Organization of Petroleum Exporting Countries (OPEC) was reported.

PART-TIME ENROLLMENT

The NCES enrollment survey mentioned earlier projected a 6-percent increase in part-time study at all levels of higher education and in all academic fields in 1977, after a 1-percent decline the previous year.[14] This same survey reported a precipitous drop of 19 percent in graduate enrollment on a part-time basis for 1976, following a 6-percent rise in 1975. While the definition of

[11] See Department of Health, Education, and Welfare, National Center for Education Statistics, prepublication press release on Survey of Opening Fall Enrollment, annual series, December 1977.
[12] "Job Market Improves for the Class of '77'," *Chronicle of Higher Education*, June 29, 1977, p. 5.
[13] See Institute of International Education, *Open Doors 1976 and 1977*. (New York: IIE Publications Division).
[14] See Department of Health, Education, and Welfare, National Center for Education Statistics, prepublication press release on Survey of Opening Fall Enrollment, *op. cit.*

Table 2. Full-time graduate science enrollment at doctorate-granting institutions by area, sex, and citizenship: 1975-76[1]

[Percent change]

Area of science	Total	Sex		Citizenship	
		Men	Women	U.S.	Foreign
Total, all areas	2.1	-0.8	11.1	1.8	3.9
Engineering	-.1	-.6	10.0	-2.0	4.1
Physical sciences	1.8	.7	9.5	2.1	.7
Environmental sciences	5.7	2.9	24.6	5.5	7.4
Mathematical sciences	2.7	1.8	6.2	.9	9.9
Life sciences	4.6	-.6	16.7	4.6	4.3
Agricultural sciences	7.5	4.5	26.3	7.5	7.3
Biological sciences	1.8	-1.1	8.7	1.8	1.3
Health sciences	10.7	-5.6	29.3	10.9	8.7
Psychology	9.3	7.5	11.6	9.5	1.9
Social sciences	-2.0	-6.4	6.0	-2.6	2.3

[1] From the Survey of Graduate Science Student Support and Postdoctorals (GSSSP).

SOURCE: National Science Foundation

a part-time student differs between NCES and NSF, it should be noted that these shifts in emphasis between full- and part-time study also occurred in graduate science programs. The large rate of increase among part-time students in 1975 (15 percent) culminated in two years of leveling off. For 1977, respondents to the QRS estimated that the number of part-time graduate science students rose only 1 percent to 82,400 in doctorate institutions. While the magnitude of the 1974-75 increase could not be expected to be maintained indefinitely, the abrupt change in 1976 and 1977 was the first slowdown in part-time growth since this survey series began in 1972.

Even though the rate of increase has slowed markedly, part-time study in S/E programs has represented a steadily growing segment of the graduate enrollment population. At doctorate-granting institutions, part-time enrollment has risen from 23 percent of the total in 1971 to 27 percent in 1976 and to an estimated 28 percent in 1977.

Engineering and the social sciences together attracted 60 percent of the part-time enrollees in both 1976 and 1977. The third-ranked area in size, the life sciences, grew by 11 percent in 1976 and by another 5 percent in 1977 to an estimated total of 14,600.

POSTDOCTORALS

The number of postdoctorals appointed to graduate science departments reached a new high of 18,700 in doctorate institutions in 1976. This segment of the S/E population was not surveyed in the 1977 QRS but indications are that with the budgeted increase of Federal funds for research and development, the increase in federally funded postdoctorals in research will probably continue.

Because so few appointments of this nature were made by master's institutions, only 45 in 1976, the following discussion has been confined to the characteristics of postdoctorals in doctorate institutions only. The temporary nature of postdoctoral research appointments makes their number vulnerable to changes in the level of academic resources available for research activities. R&D expenditures by doctorate-granting institutions rose nearly 10 percent between fiscal years 1975 and 1976—from $3.3 billion to $3.7 billion, or by 2 percent in constant dollars. The increased availability of research funding from both Federal and non-Federal sources contributed to the strong rise in postdoctoral utilization.[15] Federally appointed postdoctorals accounted for 71 percent of the total number in 1976 and rose 10 percent over 1975, corresponding to the 10-percent growth in federally sponsored R&D expenditures. The majority of the 13,300 federally supported postdoctorals held research associate positions.

[15] See National Science Foundation, *Detailed Statistical Tables. Expenditures for Scientific Activities at Universities and Colleges, Fiscal Year 1976* (NSF 77-316), *op. cit.*

Graduate departments in the life sciences utilized 65 percent of the total number of postdoctorals in 1976, or 12,200, about the same proportion as in earlier years; also 57 percent of the R&D expenditures went to fields in this category. The physical sciences departments appointed over 4,000 postdoctorals, up 3 percent from the 1975 total. Of the remaining 2,500 postdoctorals, nearly one-half were in engineering departments, and the rest were fairly evenly distributed among psychology and the social and environmental sciences, with less than 400 in each.

Master's-Granting Institutions

As stated earlier, the 1976 survey represented NSF's first attempt to gather graduate science student support and enrollment data from master's-granting institutions, a growing component of the S/E population. A short form was designed that requested enrollment status, source of major support (for full-time students only), and sex. Institutions were asked to provide full- and part-time totals for 1975 and 1976 for each graduate science department so that a short-term change could be determined. Master's institutions were also included as part of the QRS study for the first time in fall 1977.

Enrollment in graduate S/E programs at master's-granting institutions continued to rise. Full-time enrollment for 1977 is estimated at 19,600, or 6 percent more than in 1976, while part-time estimates show a 3-percent rise to 31,300 (chart 4). Overall, master's institutions were estimated to have gained 4 percent more graduate science students in 1977, following a 5-percent rise in 1976.

The fall 1976 GSSSP survey indicated some characteristics very different from those at doctorate-granting institutions:

(1) Only 38 percent of the enrollment at master's institutions was on a full-time basis, whereas in Ph.D. institutions, nearly 73 percent attended full time.

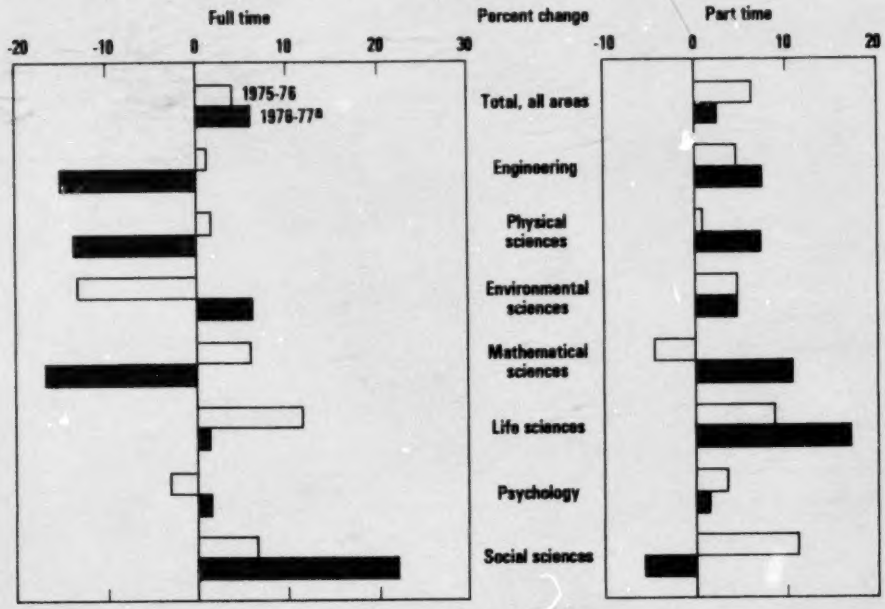
(2) Women accounted for 37 percent of the full-time students at master's institutions, but at doctorate institutions they maintained a 27-percent share.

(3) At master's institutions, 64 percent were primarily self-supporting, while 32 percent relied on self and family resources at doctorate institutions.

* * * * * * * *

The statistical tabulations of the fall 1976 GSSSP survey results were published in the report entitled, *Detailed Statistical Tables, Graduate Science Education: Student Support and Postdoctorals, Fall 1976,* (NSF 77-319), available upon request from the National Science Foundation, Division of Science Resource Studies. A final report analyzing the data from the fall 1976 survey will *not* follow this *Highlights.* **Full analytical reports will be issued biennially in the future.** For example, the next final report will contain fall 1977 GSSSP survey data and 3-year trends. For information on the availability of data tapes, please call Moshman Associates at (202)229-3000.

Chart 4. Graduate enrollment at master's-granting institutions by area and enrollment status: 1975-77



[a]Estimate from 1977 Quick Response Survey (QRS).
SOURCE: National Science Foundation

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